

REMARKS

Claims 1 - 43 are pending in the present Application. Claims 22 – 25, 29 and 31 – 43 are withdrawn from consideration. Claims 2-5, and 23-24 have been cancelled, leaving Claims 1, 6-9-21, and 26-27, and 29-30 for consideration upon entry of the present Amendment.

Claims 1, 8, 9, 22, 26, 28 and 30 have been amended.

Support for the amendment to Claim 1 can be found in claims 2, 4 and 5 as originally filed.

Support for the amendment to claims 9 and 28 can at least be found in Claim 7 as originally filed as well as in Paragraph [0028] as originally filed.

Support for the amendment to Claim 22 can be found in Claim 24 as originally filed.

Claims 8, 26, and 30 have been amended to correct the antecedent basis for the claim.

No new matter has been introduced by these amendments. Reconsideration and allowance of the claims are respectfully requested in view of the above amendments and the following remarks.

Claim Rejections Under 35 U.S.C. § 102(e)

Claims 22 and 26 stand rejected under 35 U.S.C. § 102(e), as allegedly anticipated by U.S. Patent No. 6,375,676 to Cox (hereinafter “Cox”). (Office action 04/04/08, page 2) Applicants respectfully traverse this rejection.

Claim 22 is directed to a nickel-titanium alloy composition comprising about 55.5 weight percent of nickel based on the total composition of the alloy.

In the response to the restriction requirement dated January 4, 2008, Applicants elected to prosecute the Claims of group I, specifically, claims 1-21, 26, 27, 29, and 30. Thus, Claim 22 is presently withdrawn from consideration.

Claim 26 is directed to a stent manufactured from the nickel-titanium alloy composition of Claim 22.

In making the rejection, the Examiner stated that Cox discloses a nickel-titanium alloy composition comprising about 55.5 weight percent of nickel based on the total composition of the alloy. (OA 04/04/08, page 2)

To anticipate a claim, a reference must disclose each and every element of the claim.

Lewmar Marine v. Varient Inc., 3 U.S.P.Q.2d 1766 (Fed. Cir. 1987).

Cox is directed to a self-expanding stent for implantation into a body lumen. (Abstract) Cox discloses that the stent can be laser cut from a tube of super elastic nickel titanium (Nitinol) whose transformation temperature is below body temperature. (Col. 4, ll. 44-46) The reference discloses that a suitable composition of Nitinol used in the manufacture of the stent is approximately 55% nickel and 45% titanium (by weight) with trace amounts of other elements making up about 0.5% of the composition. (Col. 14, line 1-4) Cox further discloses that the austenite transformation temperature of the Nitinol is between about -15°C and 0°C. (Col. 14, ll. 5-6) However, the reference does not disclose all elements of the present invention.

While the reference discloses that the austenite transformation temperature of the Nitinol is between about -15°C and 0°C, the reference does not disclose a nickel-titanium alloy composition wherein the alloy has a reverse martensitic transformation start (A_s) temperature of about 10°C to about 15°C and a transformation finish temperature of about 30°C to about 35°C. For at least these reasons, Cox does not teach all elements of Claim 26. Since Cox does not teach or disclose all element of the claimed invention, it cannot anticipate the claims.

Reconsideration and withdrawal of this rejection are respectfully requested.

Claim Rejections Under 35 U.S.C. § 103(a)

Claims 1 – 6 and 20, 21 stand rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over U.S. Patent No. 5,624,508 to Flomenblit et al. (hereinafter “Flomenblit”), in view of U.S. Patent No. 6,153,252 to Hossainy et al. (hereinafter “Hossainy “). Applicants respectfully traverse this rejection.

Claim 1 is directed to a medical device comprising: a nickel-titanium based shape memory alloy having a reverse martensitic transformation start (A_s) temperature of about 10°C to about 15°C and a transformation finish temperature (A_f) of about 30°C to about 35°C; and a drug coating comprising a polymeric resin and one or more biologically active agents.

For an obviousness rejection to be proper, the Examiner must meet the burden of establishing that all elements of the invention are disclosed in the prior art; that the prior art relied upon, or knowledge generally available in the art at the time of the invention, must provide some suggestion or incentive that would have motivated the skilled artisan to modify a reference or combined references. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988). “A patent composed of several elements is not proved obvious merely by demonstrating that each of its

elements was, independently, known in the prior art.” *KSR Int’l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1741 (2007). To find obviousness, the Examiner must “identify a reason that would have prompted a person of ordinary skill in the art in the relevant field to combine the elements in the way the claimed new invention does.” *Id.*

Flomenblit discloses a process for the manufacture of a two-way shape memory alloy and device. (Abstract) The reference discloses that the range of temperature over which the austenitic transformation occurs should desirably be narrow since excessive heating where the temperature range is large can cause tissue damage. (Col. 4, ll. 20-23) In this regard, Flomenblit further discloses that the temperature of the austenitic transformation, A_f , can be adjusted within a range of 10-60°C with a very narrow interval of A_f - A_s of about 1-5°C. (Col 5, ll. 39-43) This narrow temperature range is further supported in Col. 5, ll. 44-53, where Flomenblit discusses decreasing the A_f , and specifically points to examples of Nitinol alloys having respectively, an A_s and A_f of 45°C and 48°C; of 23°C and 27°C; and of 11°C and 15°C. Flomenblit also discloses methods for increasing the A_f , and specifically provides an example of a Nitinol alloy having respectively, an A_s and A_f of 46°C and 49°C. Further, in the Examples, Flomenblit provides a coiled stent having an A_s of 40°C and an A_f of 43°C (Example 1), and an esophageal stent having an A_s of 42°C and an A_f of 45°C. Therefore, as can clearly be seen, Flomenblit, both discloses and exemplifies medical devices having an A_f - A_s of about 1-5°C.

However, Flomenblit does not disclose all elements of the present claims. While the reference discloses that the A_f of the nitinol alloy falls within a range of 10-60°C, the reference clearly limits the difference in temperature between the A_f and the A_s to within about 1-5°C. Thus, the reference does not disclose a shape memory alloy having an A_f - A_s temperature range within about 15°C to about 25°C. Specifically, the reference does not disclose an alloy having a reverse martensitic transformation start temperature of about 10°C to about 15°C and a transformation finish temperature of about 30°C to about 35°C, as provided by present claim1.

As disclosed in the instant application, medical devices may be either thermally expanding or self-expanding. In the case of self-expanding devices, the present disclosure provides that it is desirable that the A_s of the shape memory alloy be greater than or equal to about 10°C and that the A_f of the shape memory alloy is within a range of about 25°C to about 37°C. (See paragraph [0021]) Thus, amended claim 1, which provides a medical device comprising a shape memory alloy having an A_s of about 10°C to about 15°C and an A_f of about

30°C to about 35°C, is clearly a self-expanding alloy.

Meanwhile, the medical devices (stents) exemplified by Flomenblit (Examples 1 and 2), require heating of the stent once it has been deployed in a tubular organ of the body to allow the occurrence of the austenitic transformation. (Col. 7, ll. 26-28; ll. 63-65) As such, the reference does not disclose medical devices that are self-expanding. Further, the reference also does not disclose a medical device comprising an alloy where the $A_f - A_s$ is greater than 1-5°C or, that there would be any advantage in a medical device comprising an alloy with an $A_f - A_s$ that is greater than 1-5°C.

As such, Applicants contend there would be no motivation to modify the reference to arrive at the present claims. Flomenblit clearly provides that there are clear advantages to having an alloy with an $A_f - A_s$ of about 1-5°C, specifically, that the since excessive heating where the temperature range is large can cause tissue damage. Thus, Applicants contend the reference teaches away from a medical device having a more broad martensite to austenite transformation range. One of skill in the art, upon reading Flomenblit, would not be motivated to increase the $A_f - A_s$ from the 1-5°C provided by Flomenblit to an $A_f - A_s$ ranging from about 15 to about 25°C, as provided by the present claims.

For at least these reasons Flomenblit does not teach or disclose all elements of the present claims.

In making the rejection the Examiner stated that Hossainy discloses that the polymeric coating should not crack during the expansion of the stent and therefore one of ordinary skill would have provided a polymeric resin having a glass transition temperature less than or equal to the reverse martensitic transformation start temperature so that the coating would not crack during expansion. (OA 04/04/08, page 4)

Hossainy is directed to a process for coating stents comprising contacting the stent with a liquid coating solution containing a film forming biocompatible polymer under conditions suitable to allow the film forming biocompatible polymer to coat at least one surface of the stent. (Abstract) In discussing the film-forming polymers that may be used for coating, Hossainy discloses that “the polymers molecular weight [is] high enough to provide sufficient toughness so that the polymers will not be rubbed off during handling or deployment of the stent and must not crack during expansion of the stent.” (Col. 5, ll. 43-7) Subsequently, the reference goes on

to disclose the optimal melting point of the polymer, and that elastomers are the preferred types of polymers. Specifically, Hossainy discloses that “[e]lastomers present the advantage that they tend to adhere well to the metal stents and can withstand significant deformation without cracking”. (Col. 7, ll. 5-57)

While Hossainy discloses film-forming polymeric coatings, the reference too does not disclose all elements of present Claim 1. Specifically, Hossainy does not disclose or suggest a nickel-titanium based shape memory alloy having a reverse martensitic transformation start temperature (A_s) of about 10°C to about 15°C and a transformation finish temperature (A_f) of about 30°C to about 35°C. For at least this reason, the combination of Flomenblit and Hossainy does not teach or suggest every element of the present claims. Further, since Hossainy does not make up for the deficiency of Flomenblit, Applicants contend there would be no motivation to combine the references.

Applicants believe the Examiner has not made a *prima facie* case of obviousness over Flomenblit in view of Hossainy. Applicants respectfully request a withdrawal of the obviousness rejection and an allowance of the claims.

Claims 1, 7, and 9 stand rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over U.S. Patent No. 6,428,634 to Besselink et al. (hereinafter “Besselink”), in view of Hossainy. (OA 04/04/08, page 6) Applicants respectfully traverse this rejection.

Applicants respectfully submit that the combination proposed by the Examiner does not teach a nickel-base shape memory alloy having a transformation start temperature of about 10°C to about 15°C, and a transformation finish temperature of about 30 to about 35°C.

Besselink is directed to a method of processing a Ni-Ti-Nb based alloy, having superelastic properties, which contains from about 4 to about 14 atomic percent Nb and in which the ratio of atomic percent Ni to atomic percent Ti is from about 0.8 to 1.2. (Abstract) Besselink states that the Ni-Ti-Nb based alloys which would normally exist in the austenite phase at ambient temperature can be stored in the martensite phase at room temperature in the deformed configuration from which they will recover when heated. (Col. 1, line 66 to Col. 2, line 3)

In making the rejection the Examiner stated that it would have been obvious to have a transformation start temperature greater than room temperature so that the alloys can be stored in martensitic phase at room temperature. (OA 04/04/08, page 6)

Besselink clearly discloses that at room temperature, which is known to those of skill in the art to be about 20 to about 25°C, that the alloy would not yet have begun the martensite to austenite transformation, but rather, remains in the martensite state. In addition, the reference also states that a further advantage of the alloy is “that the tendency found in some Ni-Ti based alloys to revert to an R-phase (a transitional phase between the austenite and martensite phase) is reduced, and that this reduces the tendency of elastic modulus to be lowered.” (Col. 2 line 66, to col. 3, line 3) Thus, Applicants contend, that one of skill in the art would understand that Besselink provides an alloy that has not yet entered the martensite to austenite transformation at ambient temperature.

Meanwhile, present Claim 1 teaches that the reverse martensitic start temperature is about 10°C to about 15°C and the transformation end temperature is about 30°C to about 35°C. As such, Claim 1 provides that at room temperature (about 20 to about 25°C), the transformation from martensite to austenite has been initiated and is in process, and thus, at room temperature, the alloy would be in a transitional phase between the austenite and martensite phases.

Therefore, for at least these reasons, Besselink does not disclose all elements of present Claim 1. Specifically, Besselink does not disclose a nickel-based shape memory alloy having a transformation start temperature of about 10°C to about 15°C, and a transformation finish temperature of about 30 to about 35°C.

With regard to the secondary reference, as discussed previously, Hossainy is silent with regard to both the optimal reverse martensitic transformation start temperature and transformation finish temperature of the nickel titanium shape memory alloy. For at least these reasons Hossainy does not disclose or suggest every element of the present claims. Further, since Hossainy does not make up for the deficiency of Besselink, there would be no motivation to combine the references.

Applicants therefore believe that the Examiner has not made a *prima facie* case of obviousness over Besselink in view of Hossainy. Applicants respectfully request a withdrawal of the obviousness rejection and an allowance of the claims.

Claims 1 and 15 stand rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over Flomenblit, in view of U.S. Patent No. 6,517,858 to Le Moel et al. (hereinafter “LeMoel”). (OA

04/04/08, page 7) Applicants respectfully traverse this rejection.

As discussed previously, Flomenblit does not disclose all elements of present Claim 1. Specifically, Flomenblit does not disclose or suggest a nickel-based shape memory alloy having a transformation start temperature of about 10°C to about 15°C, and a transformation finish temperature of about 30°C to about 35°C.

LeMoel is directed to a bioactive implant comprising a substrate coated with a polymer layer with reactive functions, and a bioactive substance fixed on the implant by means of said reactive functions. (Abstract) The reference discloses the fixation of a heparin compound onto the polymer layer during the radiografting of the polymer precursor by adding the heparin to the grafting medium containing the precursor monomer to be grafted. (Col. 5, ll. 52-57) LeMoel discloses that the substrate of the implant may be a metal or a metallic alloy. (Col. 2, ll. 33-36) However, LeMoel does not disclose all elements of amended Claim 1.

While LeMoel discloses a metallic implant coated with a polymeric resin and a biological agent, LeMoel does not disclose or suggest that the medical device is a nickel-based shape memory alloy having a transformation start temperature of about 10°C to about 15°C, and a transformation finish temperature of about 30 to about 35°C, as provided by present claim 1. For at least this reason, the combination of Flomenblit and LeMoel does not teach or suggest every element of the present claims. Further, since LeMoel does not make up for the deficiency of Flomenblit, Applicants contend there would be no motivation to combine the references.

Applicants therefore believe that the Examiner has not made a *prima facie* case of obviousness over Flomenblit in view of LeMoel. Applicants respectfully request a withdrawal for the obviousness rejection and an allowance of the claims.

Claims 1 and 16 stand rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over U.S. Patent No. 5,624,508 to Flomenblit, in view of U.S. Patent No. 6,790,228 to Hossainy et al. (hereinafter “Hossainy et al.”) Applicants respectfully traverse this rejection.

As discussed previously, Flomenblit does not disclose all elements of present Claim 1. Specifically, Flomenblit does not disclose or suggest a nickel-based shape memory alloy having a transformation start temperature of about 10°C to about 15°C, and a transformation finish temperature of about 30 to about 35°C.

Hossainy et al is directed to coatings for implantable devices, such as stents, and a

method of forming the coatings. (Abstract) The Office Action states that Hossainy et al. discloses coating a nickel-titanium stent with a drug coating comprising a polymeric resin and one or more biologically active agents, and that Hossainy et al. discloses biologically active agents encapsulated between layers of polymeric resins. (OA 04/04/08, page 8)

While Hossainy et al. discloses polymeric coatings comprising active agents it does not disclose all elements of present Claim 1. Specifically, Hossainy et al. does not disclose or suggest a nickel-titanium based shape memory alloy having a reverse martensitic transformation start temperature (A_s) of about 10°C to about 15°C and a transformation finish temperature (A_f) of about 30°C to about 35°C. For at least this reason, the combination of Flomenblit and Hossainy et al. does not teach or suggest every element of the present claims. Further, since Hossainy et al. does not make up for the deficiency of Flomenblit, Applicants contend there would be no motivation to combine the references.

Applicants therefore believe that the Examiner has no made a *prima facie* case of obviousness over Flomenblit in view of Hossainy et al. Applicants respectfully request a withdrawal for the obviousness rejection and an allowance of the claims.

Claim 27 stands rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over Cox, in view Hossainy. (OA 04/04/08, page 9) Applicants respectfully traverse this rejection.

Claim 27 is directed to the stent of Claim 26, wherein the stent is coated with a drug coating comprising a biologically active agent. Claim 26 is directed to a stent manufactured from the nickel-titanium alloy composition of Claim 22. Claim 22 is directed to a nickel-titanium alloy composition comprising about 55.5 weight percent of nickel based on the total composition of the alloy; wherein the alloy has a reverse martensitic transformation start temperature of about 10°C to about 15°C.

Claim 22 is presently withdrawn from consideration.

As discussed previously, Cox does not teach or suggest the elements of Claim 26. Specifically, Cox does not disclose a stent manufactured from a nickel-titanium alloy composition comprising about 55.5 weight percent of nickel based on the total composition of the alloy, wherein the alloy has a reverse martensitic transformation start (A_s) temperature of about 10°C to about 15°C.

In addition, as discussed previously, Hossainy also does not disclose or suggest a nickel-

titanium alloy composition comprising about 55.5 weight percent of nickel based on the total composition of the alloy, wherein the alloy has a reverse martensitic transformation start (A_s) temperature of about 10°C to about 15°C, and thus does not disclose a stent manufactured from such an alloy. For at least these reasons Hossainy does not disclose or suggest every element of the present claims. Further, since Hossainy does not make up for the deficiency of Cox, there would be no motivation to combine the references. Applicants therefore believe that the Examiner has not made a *prima facie* case of obviousness over Cox in view of Hossainy. Applicants respectfully request a withdrawal of the obviousness rejection and an allowance of the claims.

Claims 28 and 29 stand rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over Besselink. (OA 04/04/08, page 9)

Claim 30 stands rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over U.S. Patent No. 6,428,634 to Besselink et al., in view of U.S. Patent No. Hossainy. (OA 04/04/08, page 10)

Applicants respectfully traverse these rejections.

Claim 28 is directed to a nickel-titanium-niobium alloy composition comprising about 48 weight percent nickel and about 14 weight percent niobium based on the total composition of the alloy with the remainder of the alloy being titanium.

Claim 29 is directed to a stent manufactured from the composition of claim 28.

Claim 30 is directed to the stent of Claim 29, wherein the stent is coated with one or more drug coating having biologically active agents.

In the response to the restriction requirement dated January 4, 2008, Applicants elected to prosecute the Claims of group I, specifically, claims 1-21, 26, 27, 29, and 30. Thus, Claim 28 is presently withdrawn from consideration.

Besselink is directed to a method of processing a Ni-Ti-Nb based alloy which contains from about 4 to about 14 atomic percent Nb and in which the ratio of atomic percent Ni to atomic percent Ti is from about 0.8 to 1.2. (Abstract) The reference further discloses that it is preferred that the ratio of Ni to Ti is not more than about 1.2, preferably 1.1. (Col. 3, ll. 58-59) Besselink also provides a list of articles that may be manufactured from the Ni-Ti-Nb alloy including biliary and urological stents. (Col. 4, ll. 64)

Present Claim 28 teaches a composition of 48 wt% Ni, 14 wt% Nb and the balance (38 wt%) being titanium. Thus, the ratio of Ni (48 wt%) to Ti (38 wt%) is 1.26, and is outside of the range set forth by Besselink as being the optimal ratio of Ni to Ti. Thus, Besselink does not specifically disclose a nickel-titanium-niobium alloy as set forth in Claim 28.

Besselink discloses that the Ni-Ti-Nb alloy having the Ni to Ti ratio of 0.8 to 1.2, can be used to form articles having superelastic properties. However, the reference does not disclose that alternative nickel to titanium ratios outside of the range provided (i.e. 0.8 to 1.2) would allow the alloy to function as intended, that is, possessing superelastic properties and having a reduced tendency to revert to a transitional phase between the austenite and martensite phase (i.e. R-phase) which in turn reduces the tendency of the elastic modulus to be lowered. For at least this reason, Applicants contend that there would be no motivation to modify the reference to manufacture a stent using the Ni-Ti-Nb alloy provided by the present claims, as there would be no expectation of success.

In addition, Hossainy does not disclose or suggest a stent manufactured from a nickel-titanium-niobium alloy composition comprising about 48 weight percent nickel and about 14 weight percent niobium based on the total weight of the composition, and coated with one or more drugs having biologically active agents. For at least these reasons Hossainy does not disclose or suggest every element of the present claims. Further, since Hossainy does not make up for the deficiency of Besselink, there would be no motivation to combine the references. Applicants therefore believe that the Examiner has not made a *prima facie* case of obviousness over Besselink in view of Hossainy.

Applicants respectfully request a withdrawal of the obviousness rejection and an allowance of the claims.

It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and withdrawal of the objection(s) and rejection(s) and allowance of the case are respectfully requested.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130.

Respectfully submitted,

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